CLAIMS

What is claimed is:

1. A method for determining optimum bond parameters for a bond force F_B and an ultrasonic variable P_B and, optionally, at least one further bond parameter G_B of a Wire Bonder for a bond process, whereby for this determination a number of bond cycles are carried out, whereby for each bond cycle a wire connection is made between a connection point of a semiconductor chip and a connection point of a substrate in that a wire end protruding out of a capillary is melted into a ball and then, in a bond position, the wire ball is attached to the connection point of the semiconductor chip, then the wire pulled through to the required length, formed into a wire loop and attached to the connection point of the substrate, and whereby the bond force F_B, the ultrasonic variable P_B and, if necessary, the at least one further bond parameter G_B are each varied in discrete steps within a predefined range, wherein with each bond cycle n, after attaching the wire ball to the connection point of the semiconductor chip, the following steps are carried out:

a) Application of a predetermined bond force F_{B1},
b) Movement of the capillary out of the bond position in a predetermined direction whereby the current $I_n(t)$ flowing through the drive which moves the capillary is monitored in the course of time t,
c) Stopping the movement of the capillary as soon as the current $I_n(t)$ reduces,
e) Determining the maximum of the current $I_{n,max}$ ($F_{B,n}$, $P_{B,n}$, $G_{B,n}$) from the progression of the current $I_n(t)$ established during steps b) and c) whereby the variables $F_{B,n}$, $P_{B,n}$ and $G_{B,n}$ are the values for bond force F_B, the ultrasonic variable P_B and, if necessary, the at least one further bond parameter G_B set for bond cycle n,

and wherein from the values $I_{n,max}$ ($F_{B,n}$, $P_{B,n}$, $G_{B,n}$) established with the n bonding processes those values for the bond force F_B, the ultrasonic variable P_B and the, if necessary, at least one further bond parameter G_B are determined as optimum bond parameters for which the current $I_{n,max}$ ($F_{B,n}$, $P_{B,n}$, $G_{B,n}$) reaches a maximum.

2. A method for determining the optimum bond parameters for a bond force F_W and an ultrasonic variable P_W and, optionally, at least one further bond parameter G_W of a Wire Bonder for a bonding process, whereby for this determination a number of bond cycles are carried out, whereby for each bond cycle a wire connection is made between a connection point of a semiconductor chip and a connection point of a substrate, in that a wire end protruding out of a capillary is melted into a ball and then, in a bond position, the wire ball is attached to the connection point of the semiconductor chip, then the wire pulled through to the required length, formed into a wire loop and attached to the connection point of the substrate, and whereby the bond force F_W, the ultrasonic variable P_W and, if necessary, the at least one further bond parameter G_W are each varied in discrete steps within a predefined range, wherein with each

bond cycle n after attaching the wire to the connection point of the substrate the following steps are carried out:

a) Application of a predetermined bond force F_{W1},

b) Movement of the capillary out of the bond position in a predetermined direction whereby the current $I_n(t)$ flowing through the drive which moves the capillary is monitored in the course of time t,

c) Stopping the movement of the capillary as soon as the current $I_n(t)$ reduces,

f) Determining the maximum of the current $I_{n,max}$ ($F_{W,n}$, $P_{W,n}$, $G_{W,n}$) from the progression of the current $I_n(t)$ established during steps b) and c) whereby the variables $F_{W,n}$, $P_{W,n}$ and $G_{W,n}$ are the values for bond force F_W, the ultrasonic variable P_W and, if necessary, the at least one further bond parameter G_W set for bond cycle n,

and wherein from the values $I_{n,max}$ ($F_{W,n}$, $P_{W,n}$, $G_{W,n}$) established with the n bonding processes those values for the bond force F_W, the ultrasonic variable P_W and the, if necessary, at least one further bond parameter G_W are determined as optimum bond parameters for which the current $I_{n,max}$ ($F_{W,n}$, $P_{W,n}$, $G_{W,n}$) reaches a maximum.

3. A method for in situ monitoring of the quality of bond connections which are produced by means of a wire-feeding capillary of a Wire Bonder with predetermined values F_1, P_1, G_1 of a bond force F, an ultrasonic variable P and at least one further bond parameter G, wherein a to be tested, selected bond connection is made as follows:

Making a bond connection with predefined values F_2, P_2, G_2 for the bond force F, the ultrasonic variable P and the at least one further bond parameter G, whereby at least one of the values F_2, P_2, G_2 is less than the corresponding value F_1, P_1, G_1.

Carrying out a test according to the following steps:

a) Application of a predetermined bond force F_3,

b) Movement of the capillary out of the bond position in a predetermined direction whereby the current $I_n(t)$ flowing through the drive which moves the capillary is monitored over the course of time t,

c) Stopping the movement of the capillary as soon as the current I(t) reduces,

d) Determining the maximum current I_{max} (F_3, P_3, G_3) from the progression of the current I(t) established during steps b) and c);

and

Making the bond connection with the values F_1, P_1, G_1.

4. The method of claim 3, wherein the value P_2 is less than the value P_1.